

## APPENDIX I

PRELIMINARY ANTHROPOLOGIST'S REPORT - BIKINI ATOLL SURVEY 19<sup>6</sup>57

Jack A. Tobin

## Brief Historical Background

The Bikini people had lived on their atoll for many generations. They and their fellow Marshallese came under the domination of foreigners less than one hundred years ago. The German regime was succeeded by that of the Japanese at the onset of World War I. The Japanese rule was terminated by the American forces during World War II.

## Contact with the Outside World

The people of Bikini Atoll were not the isolated twentieth century "Stone Age primitives" as described by sensationalist news reporters and other journalists. They were and are, however, less sophisticated than other more acculturated Marshallese, but they had been in contact with the rest of the Marshall Islands, and had been exposed to at least some of the aspects of Western culture.

Every two months a Japanese schooner visited Bikini to purchase copra and to sell food, clothing, and other goods. Every six months a Japanese official made a visit to the atoll. Some of the Bikini people visited other atolls, married out, and attended school elsewhere. Other Marshallese visited Bikini.

Box 6, PART 1  
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The small Bikini community had developed a close in-group feeling during the years of relative isolation prior to the coming of the white man and found satisfaction and security in their closely knit personal relationships and communal life.

#### World War II and the Bikini People

The Bikini people were directly affected by World War II in that three of their young men who had been attending the Japanese government school on Jaluit Atoll were drafted as laborers and sent to Enewetak Atoll. They were later killed there in the American bombing and bombardment of that huge and important Japanese military base. There were only six Japanese soldiers at Bikini, however; wireless station operators also manned the ammunition stores. These men were all killed by American bombing and shelling. Little damage was done to Bikini, however, and the Bikini people were much better off than Marshallese in areas such as Jaluit, Enewetak and Kwajalein, where heavy fighting occurred. The Bikini people suffered as did the other Marshallese, from the cut-off of supply lines from Japan with the resultant cessation of imports of necessary consumer goods and exportation of copra. Communications were restored and wartime hardships were alleviated when the American armed forces captured the Marshall Islands early in 1944. The serious hardships of the Bikini people were yet to come however.

## Evacuation of Bikini<sup>1</sup>

Early in 1946 it was decided that Bikini Atoll was the most suitable location for the testing of atomic weapons. The Bikini people were asked to leave and, as might have been expected of a people of their historical conditioning to obedience, especially after more than a quarter of a century of autocratic Japanese rule, agreed to leave their ancestral home. The possibilities of resettlement in the Marshalls were very limited because land is scarce (only about 74 square miles) and very little of it is available for settlement. The Marshallese jealously guard their land rights and will not willingly part with them.

### Problems of Resettlement

The 166 Bikinians were offered the choice of moving to either Ujae, Lae, or Rongerik, all atolls in the northwestern Marshalls. Ujae and Lae were already regularly inhabited, but Rongerik was only exploited by the people of neighboring Rongelap, who had land rights on the atoll. These people visited Rongerik to make copra, to fish, and to gather other foods. For this reason, presumably, as well as the fact that it was the closest to Bikini, the Bikini people opted to go to Rongerik rather than Ujae or Lae.

A village was built on Rongerik by Navy Seabees and a group of Bikini men, and all of the Bikini people were moved to that

<sup>1</sup> For a detailed report of the movements of the Bikini people from Bikini to Rongerik and to Kili, see Mason, Leonard "The Bikinians A Transplanted Population," Human Organization, Vol. 9, No. 1, Spring 1950, pp. 5-15.

atoll on March 6, 1946. Rongerik has a dry land area of 0.65 square miles, scattered over approximately 17 islands. It has a lagoon area of 55.38 square miles. This is much smaller than the 2.32-square-mile land area and 229.40-square-mile lagoon area of Bikini, with its 36 islands

The attempt to settle at Rongerik was a failure, allegedly due to the insufficient natural resources. A Board of Investigation convened by the Navy on June 2, 1947, recommended that the displaced Bikinians be moved again.

The Bikinians through their leader "King" Juda, as he was erroneously christened by romantically minded newsmen, accompanied by three leaders (alab) of Bikini, inspected Rongerik, Kili, Ujilang, Wotto and Ujae to try to find a suitable place in which to relocate their people. The Bikini people were interested in getting back to their ancestral home as rapidly as possible and had allegedly regarded the past and future resettlements as only temporary.

The period from June 2, 1947, to September 1, 1947, was spent in inspecting these possible resettlement areas. On August 26, 1947 the council of the ex-Bikini people on Rongerik sent the following letter to the American authorities:

(translation): "To the Office at Kwajalein:  
Gentlemen: We the council have held a meeting to find the best place to go to. We have been to some other places to inspect and have considered them. In moving we find it quite a problem. The place we all agreed to stay on is Rongerik Atoll.  
s/We, The Council"

It was obvious that the Bikini leaders refused to accept the fact that they would not be allowed to return to Bikini some day and for that reason preferred to suffer the hardships of neighboring Rongerik to a new move, in hope of being able to return to their ancestral home.

It was decided however, that the best interests of the Bikini people would be served by transferring them to Ujilang Atoll, the westernmost of the Marshalls. Ujilang belonged to the government, as heir to the Imperial Japanese government which had seized it from its former German owners, who had "purchased" the tiny atoll from its former chief.

A group of Bikini men and Navy Seabees arrived at Ujilang in late November to prepare a village for another resettlement attempt. Shortly after their arrival, an announcement was made that the atoll of Enewetak, west of Bikini, and north of Ujilang, would be commandeered as another testing ground for atomic weapons. It was then decided that the Enewetak inhabitants would be resettled on Ujilang. This left the ex-Bikini people right where they were six months earlier, but undoubtedly with increased feelings of insecurity, frustration and general bewilderment.

In January of 1948 Anthropologist Leonard Mason of the University of Hawaii, made a field investigation of the problem at the request of the Navy. He found among other things that the relocated Bikinians were suffering serious hardships on Rongerik, and, despite a well-organized communal organization

were not getting enough to eat. He recommended that the Bikini people be moved to another location.

#### Sojourn on Kwajalein

Upon the basis of Mason's investigation and recommendation, the ex-Bikinians were again moved to a temporary location on Kwajalein Island in the middle in March, 1948. Here, in a "tent city" in the midst of Marshallese workers from far and wide, as well as thousands of American members of the armed forces, the wandering Bikinians awaited the next move. Once again a tour of inspection was made of available and possible locations for resettlement. The possibilities finally narrowed down to Wotto Atoll, which was populated, and the single island of Kili in the southern Marshalls. Kili was not populated and was U.S. Government property.

The majority of the Bikini people allegedly voted for Kili as against Wotto, and in early November of 1948 the 184 Bikinians were transferred to Kili Island.<sup>2</sup>

#### Kili Island

The new home of the Bikini people is a low single coral island about one and one half miles long, on an axis of 063° true, and is approximately three-fourths of a mile wide at its widest point. The extent of the area is only 0.36 square miles, with no lagoon area and a small fringing reef. This compares

2 The increase in population was caused by the addition of Bikinians who had married out, plus their spouses and offspring.

very unfavorably, of course, with the 2.32 square miles of dry land area, the 229.40 square miles of lagoon area, and the large reef areas of Bikini Atoll.

Kili was purchased by German traders from the local chiefs and was operated as a commercial copra plantation by the Germans. The title to the island was transferred to the Japanese Government when the Japanese seized the Marshalls in 1914. It was leased to a Japanese company and operated as a copra plantation until 1940. There were allegedly not more than about thirty Marshallese laborers working on the plantation at a time. Food was brought in from Jaluit Atoll, about thirty miles to the southeast. Chickens and swine were raised to supplement the imported foodstuffs. A small number of breadfruit trees were planted and used, but the island was primarily a copra plantation. Kili passed into the hands of the United States Government following World War II, and the few remaining plantation workers were evacuated.

Kili, lying as it does in the southern Marshall, enjoys a heavy rainfall and has rich and deep soil, for the Marshalls. Most of the island, 198.04 acres have been planted to coconut palms (191.17 acres). A taro patch area occupies the center of the island to the extent of 4.25 acres. There are a number of bearing breadfruit trees,<sup>3</sup> some edible pandanus, as well as banana, papaya and pumpkin plantings.

<sup>3</sup> A serious breadfruit blight has destroyed many of the trees on Kili and remains unchecked. A method of controlling this menace has not yet been found.

Unfortunately, the lack of a lagoon or protected anchorage presents very serious problems to the inhabitants of Kili. The unfavorable axis of the island (063-240°) in relation to the prevailing northeast trade winds and the shelving comparatively narrow reef, are factors which cause the island to be isolated during many months of the year. From December through March the equatorial front lies to the south, and northeasterly winds prevail. Landing conditions are therefore generally unfavorable. From November into late March it is possible to get a boat ashore only during a few very brief periods, because of the large breakers which crash against the rocky beaches. Copra cannot be loaded and trade goods cannot be off-loaded. These unfavorable surf conditions naturally prevent utilization of the important marine resources, which at best are infinitely poorer than those of the atoll of Bikini.

#### The Resettlement on Kili

The ex-Bikini people apparently experienced difficulty in adjusting to Kili from almost the very beginning. This was due in part to the different ecological conditions. The change from an atoll existence where marine resources were abundant and the lagoon and land areas stretched away as far as the eye could see, to a small, isolated island without a lagoon, and without the rich marine resources which are found in an atoll environment, was drastic. This psychological attitude toward Kili was and has continued to be a vital importance in the lack of adjustment. The refusal to accept the move to Kili as final

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and desirable has prevented a wholehearted attempt to adjust to the island.

The writer was closely involved with the former Bikini people during his years of service as District Anthropologist in the Marshall Island. He lived on Kili for several prolonged periods and was able to see what life on Kili is like. In his opinion the complaints of the ex-Bikini people on Kili are valid. Conditions are certainly unfavorable. There are ~~periods~~ when the island is isolated and the people are very short of food. There is no doubt that Kili could support a smaller population, if the island could be supplied adequately from the outside world. However, the only solution acceptable to the former Bikinians, as a whole, is to return them to Bikini.

#### Attempts to Aid in the Adjustment Process

The Administration of the Trust Territory made various efforts to assist the relocated Bikinians to make a successful adjustment to Kili. A fifty-foot schooner was purchased and turned over to the group. This was to be used to supply the island in addition to the regular field trip stops. The craft was soon lost in the surf due to mishandling by the inexperienced crew. A second craft was provided several years later. This was a great help but was lost in a typhoon which swept through the southern Marshalls in December of 1957. Government land was provided for the use of the Kili people on the neighboring atoll of Jaluit. Several acres on Jabwor Island were used as a village area. Houses, a storehouse, and other

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structures were erected by the government. These were to be used by the members of the Kili boat crew and others while the craft was anchored off Jabwor. Three smaller islands were provided from which the Kili residents of Jabwor could obtain coconuts, pandanus and other local foods. The typhoon wiped out the village on Jabwor and the few Kili people there left the atoll for good.

A community development project was set up to assist the Kili people to develop and exploit the resources of the island to the maximum. Handicraft production was stimulated. The production of the now famous Kili Bags has continued but other items are no longer made for export.

Attempts were made to exploit the large taro patch area as a source of food, and possibly cash income. Two taro lifts were made to Kusaie Island in the Ponape District. Large quantities of high quality taro plants were obtained and planted on Kili. It soon became obvious that the former Bikinians, to whom taro was a very minor and unimportant item, were not interested in cultivating this useful plant. It should be added that taro cultivation is becoming increasingly of less importance throughout the Marshalls, even in those areas in the southern Marshall where taro once flourished. The taro patch itself was ruined during the typhoon of December 1957. Wave action flooded the area with salt water, which killed the few plants which were left and affected the freshwater lens.

The Community Development Project on Kili was terminated some time after the typhoon. It was not continued by the community as far as I know.

Attempts by the Administration to obtain another location for the displaced Bikinians have been abortive.

The economic difficulties of the former Bikini people were alleviated when they were paid the sum of \$325,000 by the Government in exchange for the use of Bikini Atoll. The interest from the trust fund, into which \$300,000 was placed is a guaranteed income which helps the local economy. This will become less significant as the population increases, as it has since the fund was established in 1956.

#### Present Attitudes Toward Kili

The attitudes of Magistrate Juda, the leader of the Kili community, and of other leading people of the community with whom I talked on Majuro, Kwajalein and Ebeye in connection with the Bikini Atoll Survey, seemed to be unchanged.

They still say that Kili is no good, it is like a prison, there is not enough food there, and the like. The same objections which were made over a decade ago are still made. All of the people whom I interviewed stated that they wanted to return to Bikini to live. They were all very anxious about the survey and what the results would be in terms of their being allowed to return to Bikini or not.

However, I was also told that some of the people would want to be able to live on Kili, even if a return to Bikini is possible. None of those with whom I spoke said that this was their wish however. Apparently at least some of the former Bikinians have made an adjustment of sorts of Kili. I was also told, in connection with this, that even though some of the people wanted to live on Kili, everyone wants to go to Bikini first and see their home atoll.

In order to evaluate this properly one would have to interview the people now on Kili. This would be premature at this stage when the return of Bikini to its former inhabitants is not certain.

On the basis of my past experience with the former Bikinians and my recent conversations and observations in the Marshalls, I believe that the majority of these people will want to return to Bikini. Those few who have established themselves on Majuro and Ebeye, with good jobs there, may very well want to live away from Bikini at least during their working life. A few others may see the advantage of living on Kili as long as only a small number of people share the natural resources of that island with them. Bikini will undoubtedly still be the home base for all of these people however. An analagous situation can be seen in the populations of the other Marshallese communities.

This prediction is of course based upon the assumption that Bikini will be rehabilitated agriculturally, so that the people can make a living there.

## The Political Situation

Decisions on the local level are made by the council of family heads and other males. The council is headed by Magistrate Juda, who is also the senior male of the Bikini group according to the traditional system. He is the heir of the local chiefs (iroij), of Bikini. The Bikini people were also traditionally subjects of a paramount chief (iroij lablab), whose ancestor had conquered Bikini over a century ago. The paramount chiefs of Bikini had never lived on the atoll but only visited it from time to time to collect tribute from their subjects. A percentage of the cash proceeds from copra production was collected during the Japanese period.

The Bikini people, in effect, declared their independence from the paramount chief shortly after their move from Bikini. They rejected him completely and declared that the U.S. Government was their paramount chief, and not the absentee title holder, whom they complained had never done anything to help them, but only exploited them. This has been the theme for the past twenty years. On my last trip to the Marshalls I found that this attitude has not changed. They want nothing to do with Iroij Lejolo<sup>HH</sup> Kabua who holds the paramount chief's rights to Bikini according to the traditional Marshallese custom. The attitude of rejection and refusal to accept him as their leader and spokesman has hardened, if anything, after more than twenty years of independence. As I understand it, Lejolo<sup>HH</sup> continues to maintain his claim to his hereditary rights

in Bikini. This situation should be kept in mind in planning for any future negotiations concerning Bikini.<sup>4</sup>

#### Bikini Atoll Today and Its Economic Potential

I will not go into details of the condition of Bikini today. These have been covered in my daily log and in Agriculturist James Hiyane's final report of the Bikini Survey. A few salient points should be made here however.

The coconut trees and other food-bearing trees and plants have been almost completely destroyed. Most of the islands have become overgrown with vegetation.

The potential agricultural areas will have to be cleared and completely replanted. This will be a formidable task, which will extend over a long period of time. Mr. Hiyane has outlined a proposed program to accomplish this. I concur with Hiyane but think the scale of the program should be greater. All available areas of the atoll should be cleared and planted as quickly as possible. This will hasten the relocation of the exiled Bikinians on their home atoll and in the long run will be more economical.

The large islands of Bikini, Eniw, and Nam have the greatest economic potential. They were the main copra-producing islands, and the main sources of vegetable foods in the past. The smaller islands toward the southwest, such as Aerököj and Enedrik, were also valuable sources of copra and food plants in

<sup>4</sup> See Tobin, J.A., The Bikinian People, Past and Present, Majuro, Marshall Islands, October 1952, for more detailed information.

the past. Miyano reports that the agricultural potential of the islands mentioned is good. Other smaller islands and islets can also be developed later.

Unfortunately several of the islands have been completely destroyed or ruined for agriculture as a result of the explosion of atomic weapons.

The smaller islands and islets in the atoll which were never used for agricultural purposes will continue to provide birds and turtles and their eggs.

The surrounding reefs of these areas teem with fish and other marine fauna as well. This is an extremely important factor in the local economy. It will be crucial in the successful relocation of the former inhabitants of the atoll. The abundance and variety of the marine fauna on Bikini are invariably central to any discussion of that atoll by its former inhabitants. The rich natural resources of Bikini are always compared with the unfavorable situation on Kili.

Several factors point to Eneu Island as the most logical place to start the agricultural-economic rehabilitation of the atoll. The final decision should, however, be made only with the full concurrence of the Bikini people. All planning should be done with the leaders of the group. This is not only equitable but it will prevent problems after the people have returned to Bikini.

The excellent harbors off Eneu, Bikini, Nam and elsewhere in the atoll will of course be crucial in the rehabilitation

and economic stability of Bikini. The lack of a protected harbor and the concomitant inability to load copra aboard ship and send merchandise ashore have been extremely serious obstacles to successful resettlement on Kili.

#### Probable Pattern of Living on Bikini

If the former Bikini people are returned to the atoll they will probably follow much the same pattern of living as they did before the move. They will undoubtedly want to live in the same village areas as before. The main village was located on Bikini Island. This was the social and economic center of the atoll. Settlements were also located on Eneu, Nam and some of the other smaller islands. The people will need houses, copra warehouses, school buildings, churches, and the like. The leaders of the community with whom I have spoken expect that the U.S. Government will provide these buildings, just as the Rongelap people and the Ellib people were provided for. This is certainly a reasonable expectation and should be fulfilled. Some of the existing buildings, especially those on Eneu, could be repaired and remodeled. These could be used to house workers during the initial period of rehabilitation of the island. They would be of value to the community in the future as well. I have indicated the location of the former village sites and dwelling sites on the permanently inhabited islands of the atoll in my Bikini Survey Log.



The agricultural practices of the resettled islanders will probably be the same as in the past. That is, a non-intensive type of agriculture. Coconuts, arrowroot, pandanus, and whatever breadfruit that can be grown will be grown.

The resettlement program will, of course, give the Marshall Islands District Agriculture Department an excellent opportunity to plan for the most efficient use of the land in the atoll. Improved varieties of food-producing plants can be introduced and planted in the most efficient manner. The coconut groves, especially, can be planted to insure maximum production. This will be a valuable project in terms of training the local people and scientific experimentation in atoll agriculture.

I believe that the Bikini people have become more oriented toward a cash economy since their removal from the atoll. This is especially true of those who have had to cope with the cash economy prevalent at Majuro and Ebeye. This means that they will probably be very much interested in copra production and will want to maximize the yield throughout the atoll. While this will aid in the rehabilitation program and the eventual economic stability of Bikini, subsistence agriculture should not be neglected. Mr. Hiyane is, of course, well aware of this aspect of the problem of agricultural rehabilitation.

As I have indicated previously, the Bikini people can be expected to make the maximum use of the local marine resources. Birds and turtles, and their eggs, fish and shellfish, and all

all other edible marine fauna will be eagerly sought. The Tridacna and other large shellfish are especially prized by these people. The largest numbers of these animals are said to have been found in the reef area of Nam and continuing down to the end of Bokdrolul Island and the tip of this long, continuous reef. This includes the area from Bokbata Island to south of Nam, where large atomic blasts occurred. Two islands were destroyed and a large area of the reef was blown out. What effect this had on the shellfish population is unknown. It is logical to assume that many of these creatures were killed either during the blasts or as a result of the change in their environment after the blasts occurred. Another important habitat for shellfish, especially Tridacna, was said to have been the reef area around the islands of Lukøj and Jelete, which lie to the southeast of the previously mentioned area. These islands are also important as a source of birds and their eggs, as well as turtles and turtle eggs.

Utilization of the smaller islands of the atoll will of course require transportation. Some of these can be reached on foot from the neighboring large islands, but many of these islands are isolated and water transportation is necessary.

The relocatees will need a number of large sailing canoes and smaller paddling canoes. A small schooner, of the fifty-foot type used throughout the Marshalls, will probably also be needed to move between the large islands of the atoll. The smaller craft are not able to carry much cargo. Adequate

transportation for men, materials, and ultimately copra, is an absolute necessity.

It is very difficult to estimate the degree of utilization of local vs. imported foods. One can say, however, that the Bikini people will use imported foods to a much greater degree than they did before they were moved from the atoll. This, I believe, is the trend throughout the Marshalls. It is seen in the orientation toward a cash economy, based upon copra production. If the Bikinians have the money they will purchase rice, flour and sugar, which have become staple food items on Kili and elsewhere in the Marshalls. These and other foodstuffs, including coffee, tea, canned meats and canned fish, will be purchased in large quantities. They form an important part of the diet and cannot be considered to be luxuries. I would imagine that the abundance of fish and shellfish on Bikini would mean a reduction in the purchase of canned fish, and even canned meat. The availability of pork and domestic fowl locally would probably affect canned meat purchases. The use of wildfowl and turtles would also probably mean a decrease in canned meat purchases. It should be noted that canned meats and fish are very expensive in the Marshalls. These and other consumer goods must be imported over vast distances. This requirement is reflected in the cost to the consumer on the atolls.

The local foods such as arrowroot, pandanus, breadfruit, bananas and squash will undoubtedly be used in addition to imported foods. Arrowroot and pandanus were especially important and

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grew in large numbers on Bikini. Breadfruit and bananas were, I understand rare as was taro. One can safely assume that if local foods are available the people will eat them, as well as imported foods. The people of Bikini enjoy both kinds of food and will not let any of it go to waste.

Although the Bikinians will want to visit all of the islands and islets in the atoll, and to exploit their natural resources, I believe that if any of these areas were found to be hazardous because of remaining radiation the people would comply with restrictions which would be necessary. This should be a matter of local policing by the community itself. A thorough explanation should be made to the entire community, so that the reasons for imposing such restrictions would be clearly understood and appreciated by everyone. This same procedure should apply to any restrictions against eating certain food produced on Bikini.

The genetic pool of the Bikini people has changed since the move twenty years ago. Increased contact with other Marshallese has resulted in out marriages. It is probable that this trend will continue. There will probably be more travel between Bikini and other parts of the Marshalls. Ebeye and Majuro will be focal points for these movements, as will Kili, if people return there to live. There will probably be considerable travel between Bikini and neighboring Rongelap, with whom a good number of the Bikini people have kinship ties. It can be expected that more of the young people will be absent

from Bikini while attending school on Majuro, Ponape and elsewhere. These individuals will bring in new ideas, new ways of doing things, and in some cases, spouses from other groups.

I answered other related questions to the best of my ability and with the data available when our survey group met on Kwajalein. As I indicated in my covering letter, some of the questions which were posed cannot be answered now. I will try to answer them when the data are available to me.

I hope that the information presented here will be useful in planning for the possible return of the former Bikini people to their home atoll.

Jack. A. Tobin

APPENDIX II  
DOCUMENTS EXAMINED

Appendices to the Committee Report

- I. Preliminary Anthropologist's Report - Bikini Atoll Survey - 1967.  
Jack A. Tobin
- II. Documents Examined
- III. Members of Survey Team
- IV. Figure 1. Bikini Atoll - Map
- V. Brief Summary of the Radiological Status of the Bikini Atoll. Philip F. Gustafson

Additional Documents Examined

- 1. Letter of December 7, 1966, from Hon. Stewart L. Udall, Secretary of the Interior to Hon. Glenn T. Seaborg, Chairman, AEC, with paragraph deleted.
- 2. Letter of April 8, 1968, John R. Totter to members of the ad hoc committee of consultants.
- 3. Letter of April 8, 1968, John R. Totter to members of the survey team and associates.
- 4. Report entitled MEETING TO DISCUSS RETURN OF THE NATIVES TO THE BIKINI ATOLL, prepared by John R. Totter, DBM, Philip F. Gustafson, DBM, and Roy D. Maxwell, OS.
- 5. RADIOLOGICAL REPORT ON BIKINI ATOLL, April, 1968. Prepared by Philip F. Gustafson, DBM
- 6. ADDITIONS TO RADIOLOGICAL REPORT ON BIKINI ATOLL, May, 1968. Philip F. Gustafson, DBM
- 7. 1967 BIKINI RADIOLOGICAL RESURVEY--MARSHALLS. AGRICULTURE REPORT, by James T. Hiyane, District Agriculturist, Trust Territory.
- 8. EXTERNAL RADIATION LEVELS ON BIKINI ATOLL--May, 1967. HASL-190. December, 1967. Prepared by Harold L. Beck and Burton G. Bennett, Health and Safety Laboratory and Tommy F. McCraw, AEC/OS.

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9. Letter of January 8, 1968, from Edward E. Held, with attached tables. to John N. Wolfe.
10. Letter of December 11, 1967, from Edward E. Held, with attached tables, to Edward P. Hardy, Jr.
11. Letter of December 26, 1967, from Edward E. Held to Edward P. Hardy, Jr.
12. Figure: Body Burden Gamma Emitters--Rongelap exposed group. Submitted by Robert A. Conard, Brookhaven National Laboratory.
13. Figure: Estimated Body Burdens <sup>90</sup>Sr--Rongelapese. Submitted by Robert A. Conard.
14. Table: Estimated Peak Dose Per Year--Rongelap People. Submitted by Robert A. Conard.
15. Table: Comparison of Rongelap and Bikini Food. Submitted by Robert A. Conard.
16. Table: Age Distribution of Bikinians--October, 1967.
17. THE BIKINI STORY IN BRIEF. By Leonard Mason, University of Hawaii.

### APPENDIX III

#### MEMBERS OF SURVEY TEAM

Edward Held, University of Washington

Harold Beck, Health and Safety Laboratory

Burton Bennett, Health and Safety Laboratory

Arnold Joseph, Marine Sciences Council

Jack Tobin, Trust Territory

James Hiyane, Trust Territory  
(not present at meeting)

Tommy McCraw, AEC/OS

Francis Tomnovec, U. S. Naval Radiological  
Defense Laboratory (not present at meeting)

#### ASSOCIATES OF SURVEY TEAM

Philip Gustafson, AEC/BM

Joseph Rivera, Health and Safety Laboratory



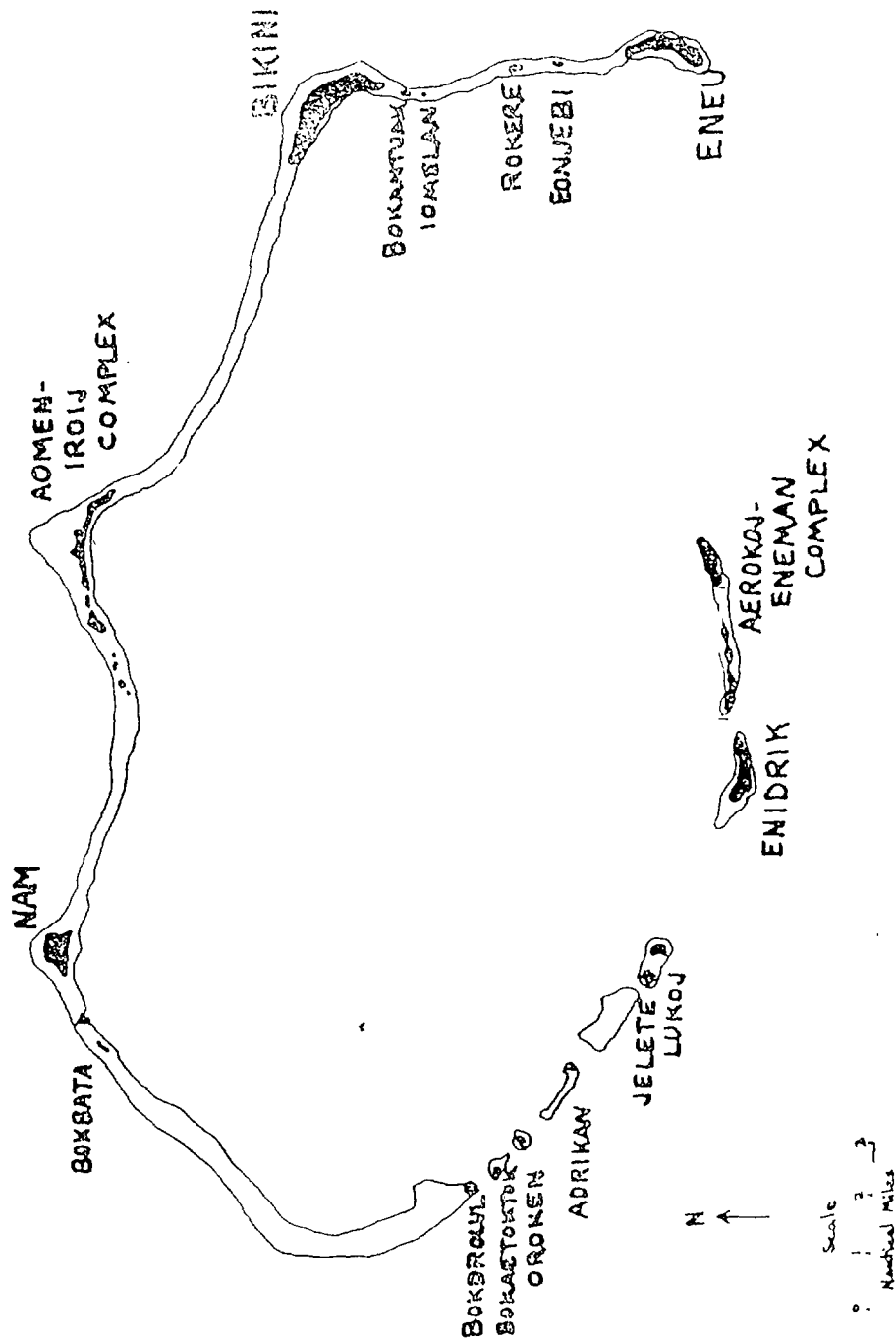


Figure 1 Bikini Atoll

## APPENDIX V

### Brief Summary of the Radiological Status of the Bikini Atoll

Philip F. Gustafson  
Fallout Studies Branch  
Division of Biology and Medicine  
May 1968

A number of radiological surveys of Bikini Atoll have been made since 1946. The most recent survey was conducted in April and May 1967. The main effort was devoted to the measurement of ambient radiation levels using several types of detectors. The external radiation field was mapped in considerable detail on Bikini and Eneu Islands, and less thoroughly on the remainder of the atoll. The various radionuclides and their concentrations which gave rise to the observed radiation field were determined from field gamma-ray spectrometry. Representative samples of local plants and animals which might be eaten by the returning natives were collected and have been analyzed for radioactivity.

The results of the 1967 survey provide a basis for making reasonable estimates of the total (external plus internal) radiation exposure which the Bikinians might receive over the coming years, if they return to the atoll. Background radiation on the atoll is due almost exclusively to cosmic radiation, and there are only trace amounts of the naturally occurring radioelements in the area. Except in the immediate vicinity of nuclear detonations, the composition of the residual gamma-ray radioactivity was similar throughout the atoll, consisting of about 70%  $^{137}\text{Cs}$ , 20%  $^{60}\text{Co}$ , and 10%  $^{125}\text{Sb}$ . Variations in intensity were observed from place to place; Eneu was the least contaminated, followed by Bikini Island itself. A dose gradient existed across Bikini, with lowest levels on the beach areas, and highest values in the heavily overgrown interior.

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The external dose received by the returned Bikinians will depend upon where various people are located, and for what periods of time, within the island complex. Location in turn depends upon whether they are men, women, or children. The returnees (see Age Distribution table) will probably consist of about equal numbers of men and women. The amount of time likely to be spent in the four radiation domains (village area, beach, interior, and lagoon) by the various groups within the population are shown in Table 1. Probably the most time will be spent in the village area, where the dose rate is intermediate between beach and interior levels. The dose rate may be reduced one half by covering the ground with an inch of clean sand or soil. This in essence will be done in the village area through the custom of covering the dirt floor and the yard with several inches of polished coral pebbles. The expected integral dose to the population over various time intervals starting in 1970 is shown in Table 2.

The actual internal dose derived from eating native foods is somewhat more difficult to assess. However, three points should be borne in mind. (1) As in the past, the natives will doubtless take much of their sustenance from the lagoon and ocean. (2) Edible land plants will be severely limited, at least at first, due to the sparcity of fruit-bearing coconut, pandanus, etc. (3) The Bikinians have become accustomed to eating new foods, and will probably continue to eat such things as rice, flour, canned meat, and powdered milk. The only radionuclides of biological importance found in foodstuffs collected at Bikini were  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$  and  $^{55}\text{Fe}$ . Other

nuclear species were either lacking or present in very low concentration. A notion of the possible daily intake of the above three radionuclides may be obtained by taking the diet eaten by the Rongelapese as a guide, and using the observed concentrations of radioactivity in the same food items collected on Bikini. The resultant daily intakes are shown in Table 3, and are compared with the daily intakes which will lead to acceptable body burdens for individuals and a suitable sample of the population. Special procedures which will greatly reduce the  $^{90}\text{Sr}$  content of the fruit can be undertaken at planting when edible pandanus is re-introduced to the Atoll. Edible fruit would be available about five years after planting. The fact that edible pandanus fruit will not be available for several years removes what might have been the major source of  $^{90}\text{Sr}$  intake and materially reduces the  $^{137}\text{Cs}$  intake as well. Removal also of land crab meat from the diet seems advisable, and such restrictions bring the  $^{90}\text{Sr}$  intake down to 115 pCi/day or 270 pCi/g Ca. The corresponding  $^{137}\text{Cs}$  intake is 2290 pCi/day.

Doses to the whole body from  $^{137}\text{Cs}$  and  $^{55}\text{Fe}$  were calculated assuming that the reduction of radioactivity in the diet occurs only from radioactive decay. Doses to bone from  $^{90}\text{Sr}$  were also computed. Because of marked differences in metabolism, adults and children were considered separately for internal dose purposes. The total doses to whole body and to bone for children and adults from internal and external radiation over 5-, 30- and 70-year intervals starting in 1970 are indicated in Table 4. The doses acceptable for individuals and for a suitable sample of the population during the same time intervals are also indicated.

5009097

The estimated  $^{90}\text{Sr}$  dose to bone is maximal because additions of calcium to the diet could readily reduce  $^{90}\text{Sr}$  uptake.

It appears unlikely that, with moderate restrictions on living and eating habits, the dose to the whole body or to bone will reach 2 rads in 5 years, 10 rads in 30 years or 16 rads in 70 years.

5009098

TABLE 1

## Population and Time Breakdowns

| Population          | Breakdown (%) | Estimated Time Breakdown (%) |              |                 |               |
|---------------------|---------------|------------------------------|--------------|-----------------|---------------|
|                     |               | <u>Village</u>               | <u>Beach</u> | <u>Interior</u> | <u>Lagoon</u> |
| Children (0-15 yrs) | 50            | 70                           | 20           | 10              | --            |
| Women               | 25            | 65                           | 15           | 20              | --            |
| Men                 | 25            | 60                           | 10           | 20              | 10            |

TABLE 2

## Integral External Doses Starting in 1970

| <u>Time Interval (years)</u> | <u>Integral Dose (mrad)</u> |
|------------------------------|-----------------------------|
| 5                            | 152                         |
| 10                           | 1391                        |
| 20                           | 2455                        |
| 30                           | 3332                        |
| 50                           | 4711                        |
| 70                           | 5743                        |

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TABLE 3

Estimated Daily Intake of  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ , and  $^{55}\text{Fe}$   
from Bikini Foods, (pCi/day)

| Food Item  | Weight consumed<br>per day (g) | $^{90}\text{Sr}$ | $^{137}\text{Cs}$ | $^{55}\text{Fe}$ |
|------------|--------------------------------|------------------|-------------------|------------------|
| Fish       | 554                            | 105              | 178               | 55,400           |
| Birds      | 41                             | 5.3              | 1,080             | 4,100            |
| Arrowroot* | 41                             | --               | --                | --               |
| Coconut    | 9                              | 1.7              | 1,030             | --               |
| Clams      | 45                             | 1.8              | 1.0               | --               |
| Imports    | 32                             | .5               | 1.0               | --               |
| Total**    | 782*****                       | 115              | 2,290             | 59,500           |

\*\*\* Acceptable intake for  
suitable sample 600 pCi/g Ca 7,000 87,000

\*\*\* Acceptable intake for  
individuals 1,800 pCi/g Ca 21,000 200,000

\*  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  are removed in the processing of arrowroot to make flour

\*\* This diet contains 0.42 g calcium per day

\*\*\* Calculated in the following way:

$$\text{Daily intake} = \frac{\text{MPL}}{1.44 \times T_{1/2} \text{ (biological)}}$$

where the value of the MPL for individuals is 1/10, and for suitable sample is 1/30 of the value for radiation workers

\*\*\*\* Other foodstuffs, (free from radioisotopic contamination) necessarily will supplement this diet.

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TABLE 4

## Summary of Radiation Exposure (rads)

## Adults

| Years | Bone<br>( <sup>90</sup> Sr)* | Internal<br>Whole body<br>( <sup>137</sup> Cs & <sup>55</sup> Fe) | External   |      | Total | Reference Values** |                |
|-------|------------------------------|---|------------|------|-------|--------------------|----------------|
|       |                              |   | Whole Body | Bone |       | At .17 rad/year    | At .5 rad/year |
| 5     | .09                          | .68   | .75        | 1.43 | 1.52  | .85                | 2.5            |
| 30    | 1.37                         | 2.68  | 3.33       | 6.01 | 7.38  | 5.1                | 15.0           |
| 70    | 3.10                         | 4.20  | 5.74       | 9.94 | 13.04 | 11.9               | 35.0           |

## Children

|    |      |      |      |      |       |      |      |
|----|------|------|------|------|-------|------|------|
| 5  | .98  | .41  | .75  | 1.16 | 2.14  | .85  | 2.5  |
| 30 | 4.06 | 1.99 | 3.33 | 5.32 | 9.38  | 5.1  | 15.0 |
| 70 | 6.16 | 4.00 | 5.74 | 9.74 | 15.90 | 11.9 | 35.0 |

\* Initial <sup>90</sup>Sr intake of 115 pCi/day or 270 pCi/g Ca by both children and adults.

\*\* Acceptable exposure for individuals is .5rad/year. Acceptable exposure for suitable sample of the population is .17rad/year.

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